Towards Cognitive BPM as the Next Generation BPM Platform for Analytics-Driven Business Processes

Hamid R. Motahari Nezhad(✉) and Rama Akkiraju

IBM Almaden Research Center, San Jose, CA, USA
{motahari,akkiraju}@us.ibm.com

Abstract. Human-centric business processes in the enterprise are knowledge-intensive, and rely on human judgment for decision making. This reliance impacts the integrity, uniformity, efficiency and consistency of the process enactment over time. We describe our experience and challenges in driving the adoption of business process management tools in the sales process at a large IT services provider. We argue that in knowledge-driven and human-centric activities such as IT services sales, current technologies do not meet the needs. They do not support data capture and analytics around process and using it to reason about and take action on the process. Process definition and enactment, both, needs to be dynamic, flexible and adaptive based on the understanding of the state of affairs. We present a vision and a framework for a *cognitive BPM system* where the knowledge management, user interaction and analytics are employed to dynamically assess and proactively adapt the process based on the results of data analytics and continuous learning from the actions taken.

Keywords: Human-centric BPM · Management issues and empirical studies · Non-traditional BPM scenarios · Analytics-driven BPM · Cognitive Computing

1 Introduction

The field of business process management (BPM) has gone through many waves of insight and innovation in its journey. From work simplification concepts originated in early 1900s through quality control and quality management awareness in the late 1980s and early 2000s to management theory frameworks such as Balanced Score Card, and process and IT frameworks (SCOR, CIBIT, eTom) to the recent social, mobile, smart (sensor-based) and adaptive BPM themes - all have emerged to adapt to the business and technological innovations in the industry. The latest insight in BPM field, driven by today's market dynamics and the need to be agile and adaptive, is analytics-driven BPM.

Driven by market momentum around social, mobile and cloud based technological innovations, companies are under constant pressure to be agile, and to proactively respond to changes in the marketplace by adapting their business processes in near real-time. For example, client relationship management (CRM) products these days can no longer rely on structured enterprise data and pre-defined processes alone. They have to monitor, mine and analyze the continuous feedback being received through various social channels such as Facebook posts, Twitter tweets, and other public and private

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discussion forum postings. By continuously collecting and analyzing real-time data from social, mobile and other platforms together with the more traditional enterprise data, companies can observe trends, take corrective actions and improve business outcomes. Analytics of various kinds including predictive, prescriptive, discovery, descriptive and diagnostic [2] play a critical role in business processes.

In this position paper, we report on observations from our efforts and experiences in developing and deploying BPM tools at a large IT services provider. We argue that in knowledge-driven and human-centric activities such as IT services sales where data-driven understanding leads to decisions in the process, rigid, pre-defined process definitions do not meet the needs. Process definition and enactment, both, have to be dynamic, flexible and adaptive based on the understanding of the state of affairs. We present a framework and approach for a *cognitive BPM system* where the process dynamically adapts to the situation at hand based on the results of data analytics and continuously learns from the actions taken (as articulated in newly emerged cognitive computing paradigm [1]).

The rest of the paper is structured as follows. In Sect. 2, we provide a brief overview of advances in BPM space is support of human-centric processes. In Sect. 3, we describe our observation of the challenges for supporting analytics-driven human processes. Section 4 presents a framework and our vision of cognitive BPM for supporting analytics-driven BPM, and discusses current progress and the steps toward defining and developing cognitive BPM. Finally, we conclude in Sect. 5.

2 BPM Advances in Support of Human-Centric Processes

Traditional business process management [5], workflow management systems [4] and process-aware information systems [6] excel at supporting the automation of well-specified, repetitive and highly automatable business processes. There has been a considerable effort in supporting flexibility in business processes [7] and supporting human-centered work in the context of case management applications [8], artifact-centric processes [9], and process analytics and predictive monitoring [10]. These efforts have been focused on using information of the process execution in order to adapt or change its course of execution. Another category of existing work focuses on analyzing the past execution data of the process in order to recommend future course of actions for new execution cases [7, 8]. However, information from the bigger context that is a container for the execution of process, and analytics using this data has less been explored for supporting the automation of human-centric processes, and not only to adapt the execution but to adapt the process model by creating different variations of the process model for different contexts, where each perform well.

The challenges of supporting human-centric processes in the enterprise is also studied in [11]. The major shift that we witness today is that the decisions on how to define, refine, enact and adapt the process is made as the result of data analytics, with data that comes from the context of the process, and all external channels such as social media, devices, Internet, enterprise repositories, etc. These are the basis for defining a cognitive business process management system in which analytics results enable process management systems to sense, analyze, learn and as a result constantly and

automatically adapt the system to reflect the context and situation that it is running in, and achieve situational awareness, self-learning and adaptiveness.

3 Analytics-Driven Enactment of Human-Centric Processes

We are into a new era of computing, where an enormous volume of data is generated and gathered around us, and used to make business decisions. In the following, we discuss how people in today's data-rich environment work in the context of human-centric sales processes in an IT service provider environment.

The main characteristic of human-centric processes is that they are described at a high level of abstraction (reference level), and the detailed activities are decided upon, performed and orchestrated by humans. One of the main reasons that such processes have still remained as "human-centric" is the need for capturing, interpreting and reasoning on the data that drives process decisions, and the need for continuous evaluation of the situation to adapt the actions, create variations of the process for different purposes, and re-execute some process steps with new knowledge. That is, partly, why traditional process automation solutions and their flexible and adaptive variations have not yet got wide-spread adoption in the industry. It is important to study how people work today in the absence of process automation tools for human-centric processes. How humans take their understanding of work context into account, and what are the desired features for such tools. We take as an example the IT service sales process, in which people form multiple departments inside an enterprise services organization get involved and collaborate.

The need for a business-aware automation solution for human-centric processes: A survey of sales professional in the studied IT service provider company asking about priority areas for sales process improvements ranks automation and tool support right after few important changes to the reference process itself, which can be considered as cognitive feedback on the process. While the need for process automation tools has a productivity-gain motivation, as a secondary criteria, as the sales executives and teams expect to eliminate the need for manual tracking of activities, they stress that the tool should capture and understand the business context, and use this information to make dynamic suggestions based on gained insights on what works better, and when to achieve better business outcome. This is a key factor in making the business case for deployment of BPM tools.

Multiple data sources feeding process decisions: there are multiple information systems, data repositories and data sources (social media, news, financial information) and information from interactions with internal and external people (email, social networking, chat, client interactions, etc.) that are used as feeds by sales people to make decisions proactively and reactively. These decisions may have major impact on process activities, and therefore require flexibility of process automation systems in adapting the process definition and execution in a continuous manner.

Inbox used a work management system: The lack of automation support for sales process has driven sales people to use their email, an unstructured knowledge and

interaction management tool, into a work and process management system through a combination of defining folders, rules, tagging and taking various feeds into their inbox and categorization. Nonetheless, this approach is still manual, error-prone and requires a high level of discipline and organization.

Changes to process guidelines and templates are commonplace and communicated through email: As more data has become available, and therefore agile decisions made in various parts of the business, the description of the overall sales process and guidelines on process steps and also document templates are updated more frequently, and in a faster pace. While these changes are posted to corresponding websites, the main method for communicating process changes is through emails, which highlights the need for processing unstructured information in order to understand the need for changing process definitions and process execution instances.

4 Future BPM Platforms for Supporting Analytics-Driven BPM

Two key shortcoming of current BPM suite of technologies for supporting human-centric are: lack of data-driven understanding of the context to drive process decisions, and using the result of analytics to adapt the process execution and process model (including annotating it, and creating multiple variations of it for different contexts) to accommodate continuous data and process decision updates.

Analytics-driving process model definition and adaptation: the first observation is that often process cannot be modeled in details in advance. Based on the reference process model, and a library of available actions, defined or learned, the concrete activities and decision on the dynamic composition of process activities is driven by analytics results. A research question in this context is how to learn process activities, and compose the process automatically based on results of an analytics? For example, reacting to a customer churn prediction, how to adapt/compose a process that reduces the chances of customer leaving (finds what customers like and puts together the best set of actions to attract or retain the customers).

Analytics supporting the adaptation of process enactment: As new information become available, new analytics results become available in different classes of predictive, descriptive, prescriptive and discovery analytics. Each class of analytics, may impact what process activities and how they are executed. In particular, predictive analytics need to be extended in the context of the processes to identify what process steps and resources may be needed as the result of certain business-focused predictions. For instance, based on such predictions, to suggest to create alternative paths (or variations of the process) in the process for different set of customers to maximize business outcome. Other types of analytics should be also reconsidered in the context of process enactment on how they would impact the process and business outcome.

The need for flexibility may comprise addressing the following requirements, though in a new analytic-driven approach: (i) ability to start from reference process and

activities, and compose the process in a data-driven approach, (ii) ability to adapt the reference process, and create additional annotations to show e.g., the business performance of actions, in an automated approach. (ii) typical to other human-centric activities, ability to adapt the process step, e.g., re-execute a step (or a fragment of the process) in a context-aware manner, (iii) ability to make reasoning, and answer questions about the what-if-scenarios about the process based on analytics (predictive, discoveries, descriptive, etc.), and support proactive vs. reactive paradigm for decision makings. (iv) ability to process unstructured information available in personal communication, interaction and news feeds (social) and across multiple channels and devices in order to support process automation, (v) integrated artifact (structured data) and process management: today the artifacts and processes are managed separately by different systems. Analytics-driven BPM needs a holistic view on how data is relevant to process execution, (vi) revisiting main process notions and definitions, for example revisiting the notion of task completion. Current workflow systems consider a task instance closed once it is marked as completed. However, in practice, the task may not be completed and be subject to several (unplanned) revisions before the process ends.

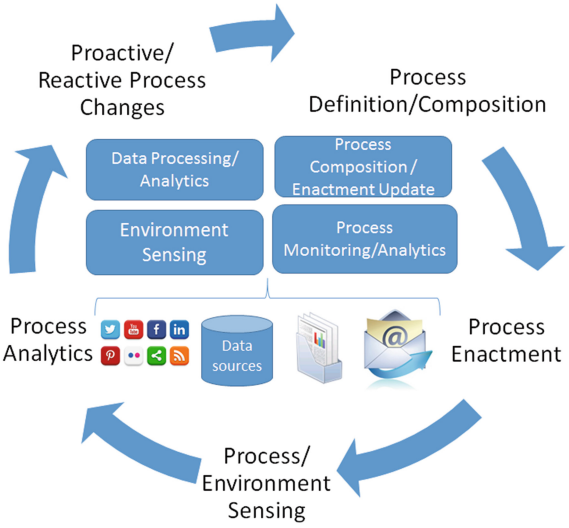

Fig 1. Our vision for the lifecycle of a Cognitive BPM platform

We believe that BPM field is about to undergo profound transformations in the coming few years into what we call a cognitive BPM. Our vision for such a cognitive BPM platform is shown in Fig. 1. The advancement of Big Data tools and platforms, and the success of cognitive computing [1] platforms such as IBM Watson make it possible to analyze massive amounts of data in real-time to provide insights at a scale and magnitude that was not possible before. As noted from our experiences with IT services sales domain, those domains that have to deal with large amounts of (unstructured) data to understand the process updates over different channels to dynamically adapt business processes. We have taken the first step in this direction by

processing sales people interactions over email and chat to automatically identify process tasks, and any update to them, reported in [12]. We envision a self-learning, cognitive sales process that is fully instrumented with probes and data collected from both internal and external sources. As the world becomes more instrumented and more data gets generated, and as enterprises' capabilities improve to mine their own internal data, the need to combine all this to make sense and to take actions that lead to desired outcomes becomes even more prominent. BPM vendors must make plans for enabling their BPM platforms with these cognitive capabilities to support analytics-driven business processes.

5 Conclusions

In this position paper, we have presented our observations and challenges noted in deploying business process management (BPM) tools in IT services sales process at a large IT services provider organization. We argue that in knowledge-driven and human-centric activities such as IT services sales where data-driven understanding leads to decisions in the process, rigid, pre-defined process definitions do not quite work. Process definition and enactment, both, have to be dynamic, flexible and adaptive to the results of analytics. We presented a framework for cognitive BPM as a next generation platform for analytics-driven business processes.

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